

# **New Overlay Penetrant Inspection Option to Support Life-Cycle Inspection**

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**New Technology Transfer Report from P-Met High-Tech Co. Pvt. Ltd.  
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# OVERVIEW

- **LIFE CYCLE CONSIDERATIONS HAVE EVOLVED AS CRITICAL ELEMENTS IN MODERN STRUCTURES AND SYSTEMS DESIGN AND USE**
- **NONDESTRUCTIVE TESTING (NDT) CAPABILITIES ARE INTEGRAL TO AND ARE OFTEN CRITICAL TO LIFE CYCLE ANALYSES IN SPACE SYSTEMS AND TO SYSTEMS IN THE PUBLIC DOMAIN**
- **LIQUID PENETRANT IS A POPULAR METHOD USED TO ASSESS STRUCTURAL INTEGRITY.**
- **THIS PRESENTATION INTRODUCES A NEW METHOD OF DOCUMENTING THE RESULTS OF A LIQUID PENETRANT ASSESSMENT PROCESS**

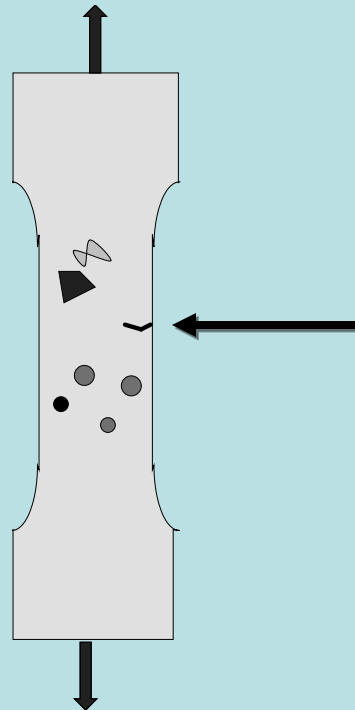
# BACKGROUND

**STRUCTURAL MATERIALS LIFE IS STRONGLY DEPENDENT ON:**

- THE INITIAL STATE AND MICRO-IMPERFECTION CONTENT
- ON THE IN-SERVICE LOADING
- OPERATIONAL ENVIROMENTS

**STRESS  
CONCENTRATION**

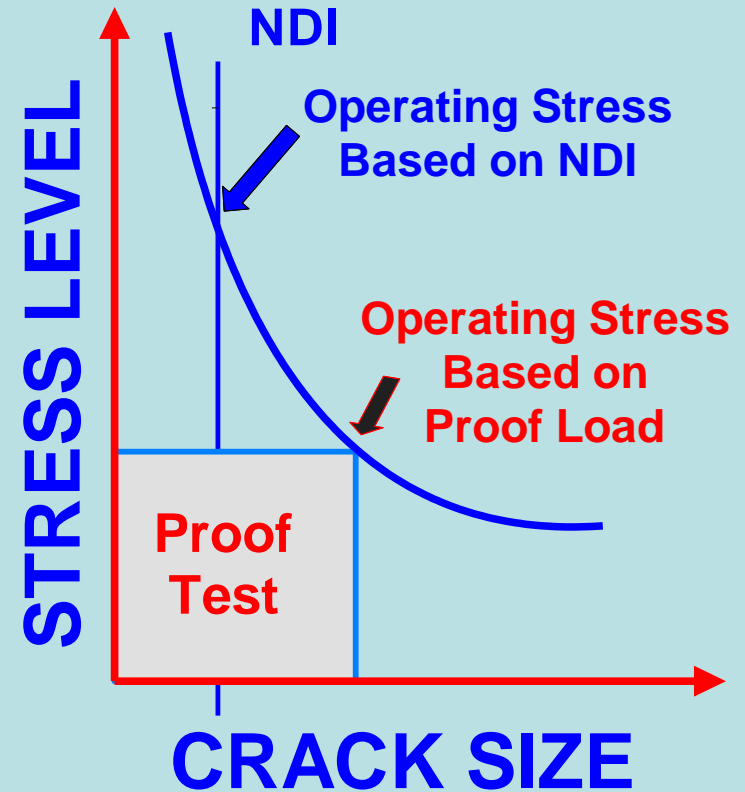
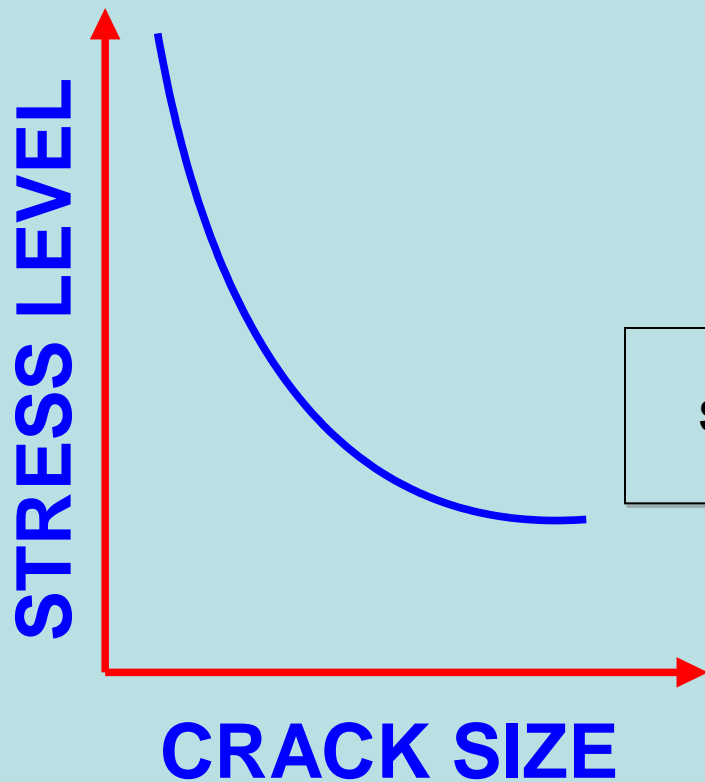
**The  
STATIC  
CASE**



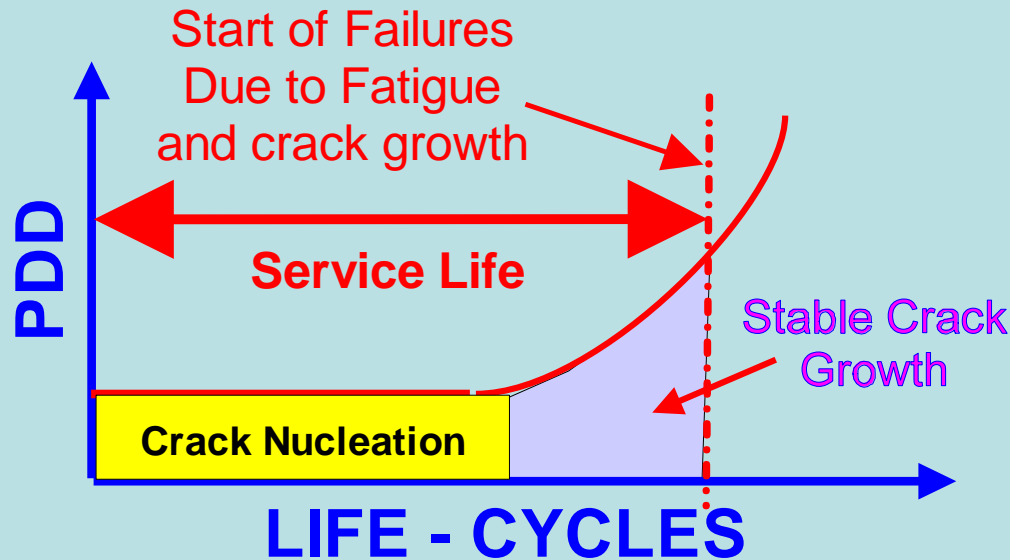
**Specimen  
will fail  
at the  
crack site**

# MATERIAL FRACTURE

Critical Crack Size Varies with Stress Level

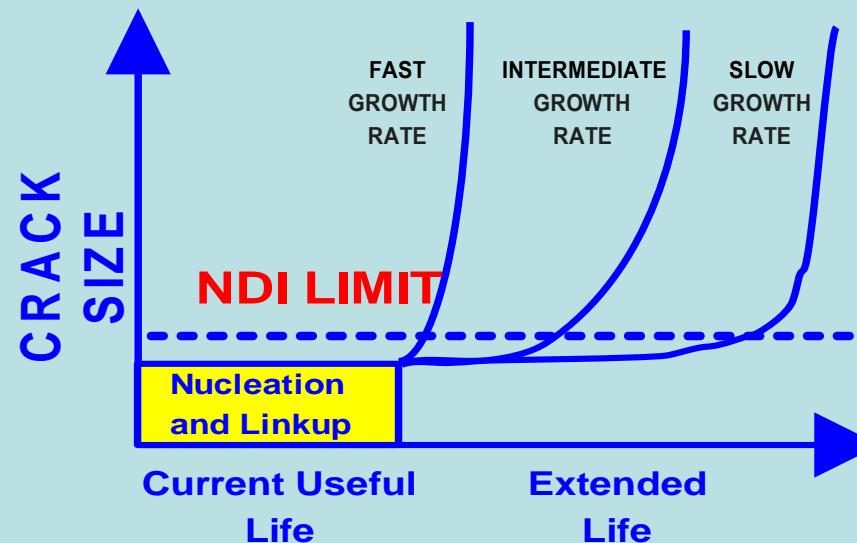


# The Dynamic Case

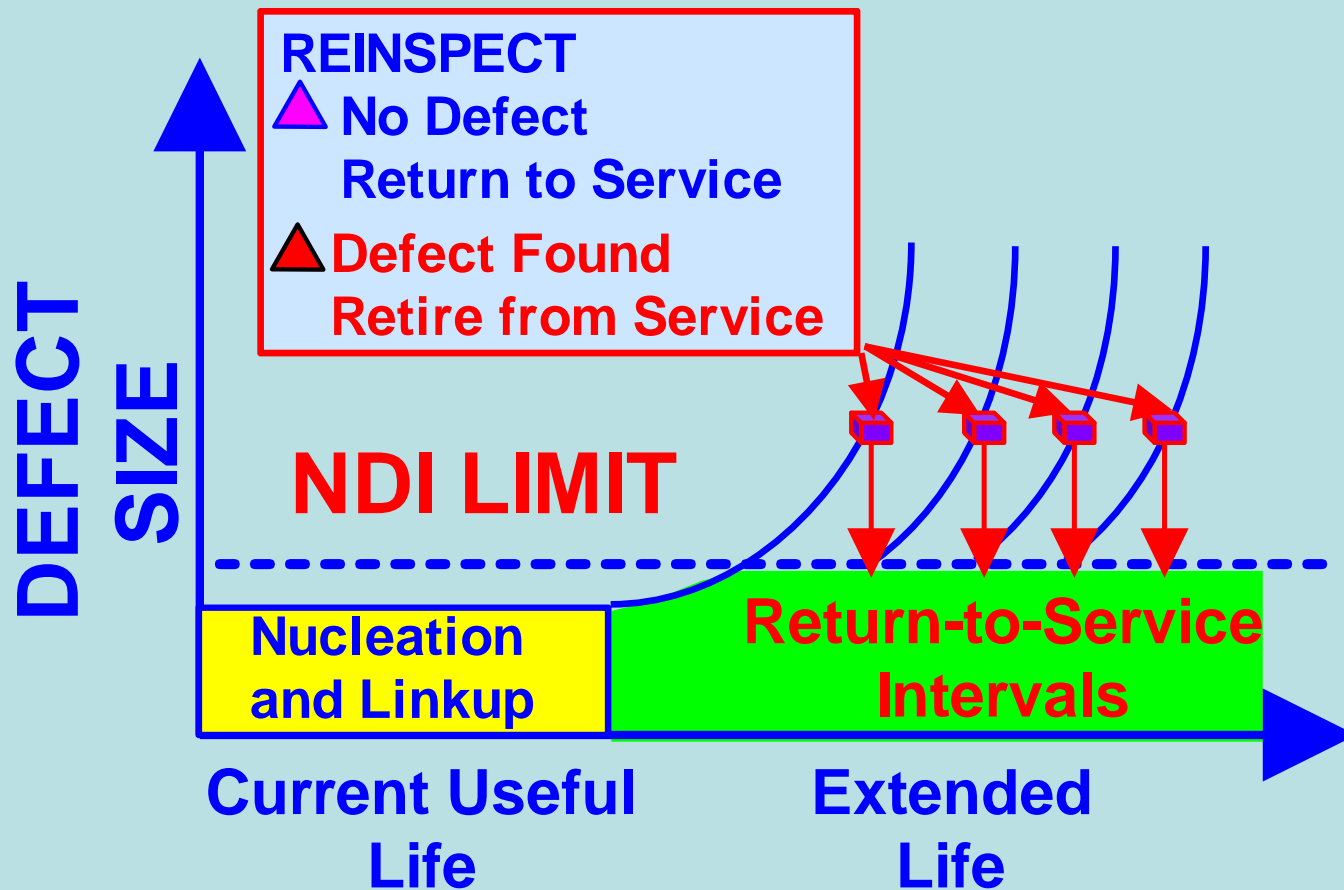


**INITIAL CRACK SIZE  
BY NDI**

**SLOW CRACK GROWTH**



# ***LIFE MANAGEMENT***



**THROW IT AWAY JUST  
BEFORE IT BREAKS**

# SMALL AIRFRAME CRACK



**Crack and Fracture at  
a Fastener Hole in a T-  
38 Aircraft Wing**



**CRACK SIZE SCREENING IS OFTEN BY NDI  
AND  
IS OFTEN BY THE LIQUID PENETRANT METHOD**

**IN SERVICE INSPECTION IS OFTEN BY  
THE LIQUID PENETRANT METHOD**

**IN BOTH SYSTEM DESIGN AND IN LIFE  
CYCLE MAINTENANCE, IT WOULD BE USEFUL  
TO HAVE A RECORD ON CRACK GROWTH**

**A NEW METHOD OF RECORDING LIQUID  
PENETRANT INDICATIONS HAS BEEN INTRODUCED  
BY P-MET**

**IMAGES SHOWN ARE ON PROCESS CONTROL  
TEST SPECIMENS THAT ARE ROUTINELY USED  
TO ASSESS THE PERFORMANCE OF AN  
APPLIED LIQUID PENETRANT INSPECTION PROCESS**



## A TYPICAL LIQUID PENETRANT INSPECTION PROCESS



## APPLICATION OF A STRIPPABLE FILM TO RECORD RESULTS

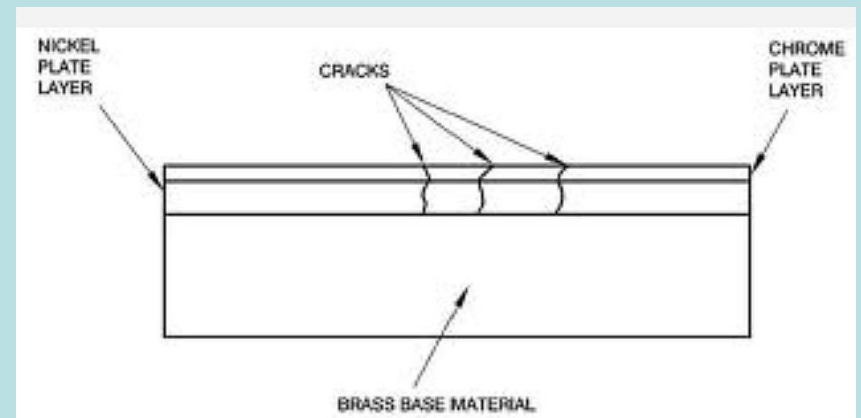


## REMOVAL AND PRESERVATION OF THE FILM RECORD



# EXAMPLE FILMS ON

- **CRACKED CHROME (SHALLOW CRACK PANELS)**



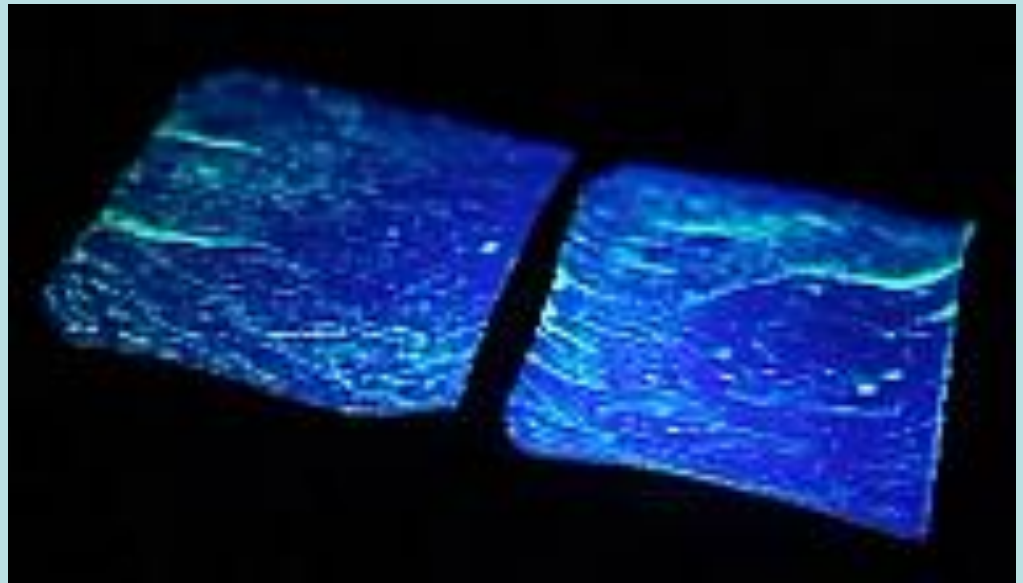
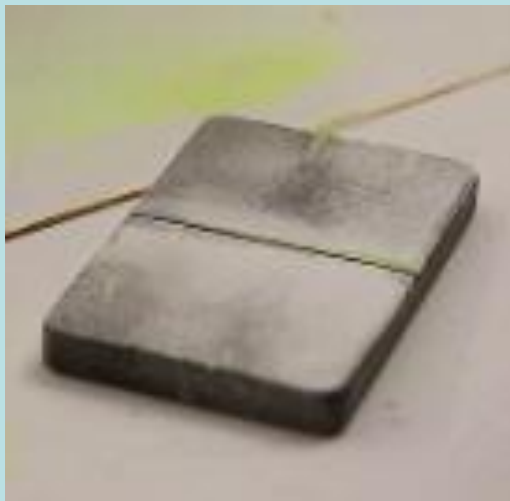
# EXAMPLE FILMS ON

- **IMPACT CRACKED PANELS (TAM AND PSM)**



# EXAMPLE FILMS ON

- **QUENCH CRACKED ALUMINUM PANELS**



# SUMMARY

- THE STRIPPABLE FILM OFFERS A SIMPLE PROCESS TO RECORD LIQUID PENETRANT INSPECTION RESULTS
- IT OFFERS SOME ENHANCEMENT OF INSPECTION RESULTS
- IT IS APPLICABLE TO BOTH VISIBLE AND FLUORESCENT PENETRANT PROCESSES
- IT IS ANTICIPATED TO BE MOST USEFUL FOR DOCUMENTING INCREMENTAL RESULTS IN STRUCTURES TEST VALIDATIONS AND IN DOCUMENTING AREAS WITH DIFFICULT ACCESS
- WORK REMAINS TO QUALIFY THE METHOD AND MATERIALS FOR COMMERCIAL APPLICATIONS AND TO ASSESS THE AGING CHARACTERISTICS OF THE FILMS



# THANKS FOR SHARING

- **P-Met High-Tech Co. Pvt. Ltd.**  
**Gorwa, Baroda – 390 016,**  
**(Gujart) INDIA**
- **Mr. Devendra M. Mehta, Managing**  
**Director, and his creative employees**